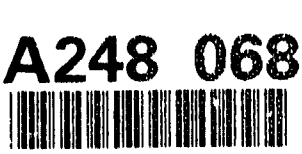


MISSILE COUNTERMEASURE DEVICE (MCD) EFFECTIVENESS ANALYSIS

1. BACKGROUND. A Missile Countermeasure Device (MCD) is an IR Jammer which deceives the guidance system of Anti-Tank Guided Missiles (ATGM's). The Combat Vehicle Survivability Assessment Cell (CVSAC) conducted a study to determine the survivability impact of a modified Missile Countermeasure Device (MCD). The CVSAC used Groundwars, a force-on-force stochastic computer model developed and maintained by AMSAA, to analyze the effectiveness of an MCD with a Field of View (FOV) of 40° and the impact of using a Missile Warning System (MWS) to cue MCD activation and orientation. AMSAA has concurred with the analysis methodology and results.

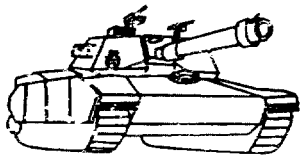
2. ASSUMPTIONS/SET-UP. For this study, Blue forces had an MCD, which was always "on"; each Blue system "knew" if it was the target. Once an ATGM was launched, the crew and MWS were able to detect and locate the missile position with enough speed and accuracy to enable a countermeasure response. The turret could slew an additional 30° in either direction to capture an incoming ATGM with the MCD. We assumed no loss of effectiveness from slewing the turret. There was a five degree uncertainty in the angle of arrival, and MCD effectiveness was constant over range. The study analyzed no MCD (Baseline), an MCD with a 40° FOV and a 60° FOV with no detection, crew detection, and an MWS. Blue used Kinetic Energy (KE) rounds (maximum firing range 2500m) and thermal sensors. Red used ATGM's (maximum firing range 3500m) and visual sensors. Ten Blue vs. six Red were used when Blue attacked, ten Red vs. three Blue were used when Red attacked.

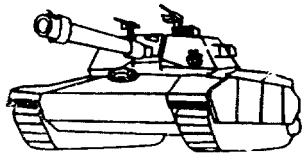
3. RESULTS. The MCD showed benefit in both Blue attack and Blue defense, but greater benefit was shown in attack. The MCD combined with the MWS and turret slewing provided the most improvement in survivability. This suite doubled the percentage of shots defeated compared to the MCD alone. The exchange ratio doubled compared to the basecase in the defense, and tripled in the attack. Turret slewing upon crew detection appeared only slightly beneficial.

4. THE WAY AHEAD. The analysis results indicate that using a sensor to cue an MCD response will enhance our countermeasure capabilities. Additional analysis is needed to assess the impact of having a more accurate sensor, a fully steerable MCD, and an automatic turret slewing capability. Additional analysis is also needed to identify an optimal MCD FOV.

Missile Countermeasure Device Effectiveness Analysis

27 January 1992





Combat Vehicle Survivability Assessment Ceil

PEO ASM / USATACOM

Warren, Michigan

Report No. 001

PURPOSE

- Analyze the effectiveness of the MCD with a smaller Field of View (FOV) than was used in the M1A2 Aircraft Survivability Equipment Analysis, 7 Jan 91, prepared by SURVIAC

- Examine the effects of turret slewing with an MCD using visual crew detection or a Missile Warning System (MWS)

MCD Methodology

- Reviewed by AMSAA
- Only Blue has MCD
- MCD is always on
- System knows if it is the target
- Turret can slew an additional 30 degrees in either direction to capture an incoming ATGM in the MCD FOV
- No effectiveness lost from slewing
- 5 degree uncertainty in angle of arrival
- The effectiveness of the MCD is constant over range.

BLUE VS. RED ASSUMPTIONS

BLUE	RED
Kinetic Energy (KE)	Anti-Tank Guided Missile (ATGM)
Thermal sensor	Visual sensor - 7 Km
2500 ▪ Max firing range	3500 ▪ Max firing range
no jockeying	jockeying
10 blue vs. 6 red when blue is the attacker	10 red vs. 3 blue when red is the attacker

Selected Suites
for Blue Attack and Blue Defense

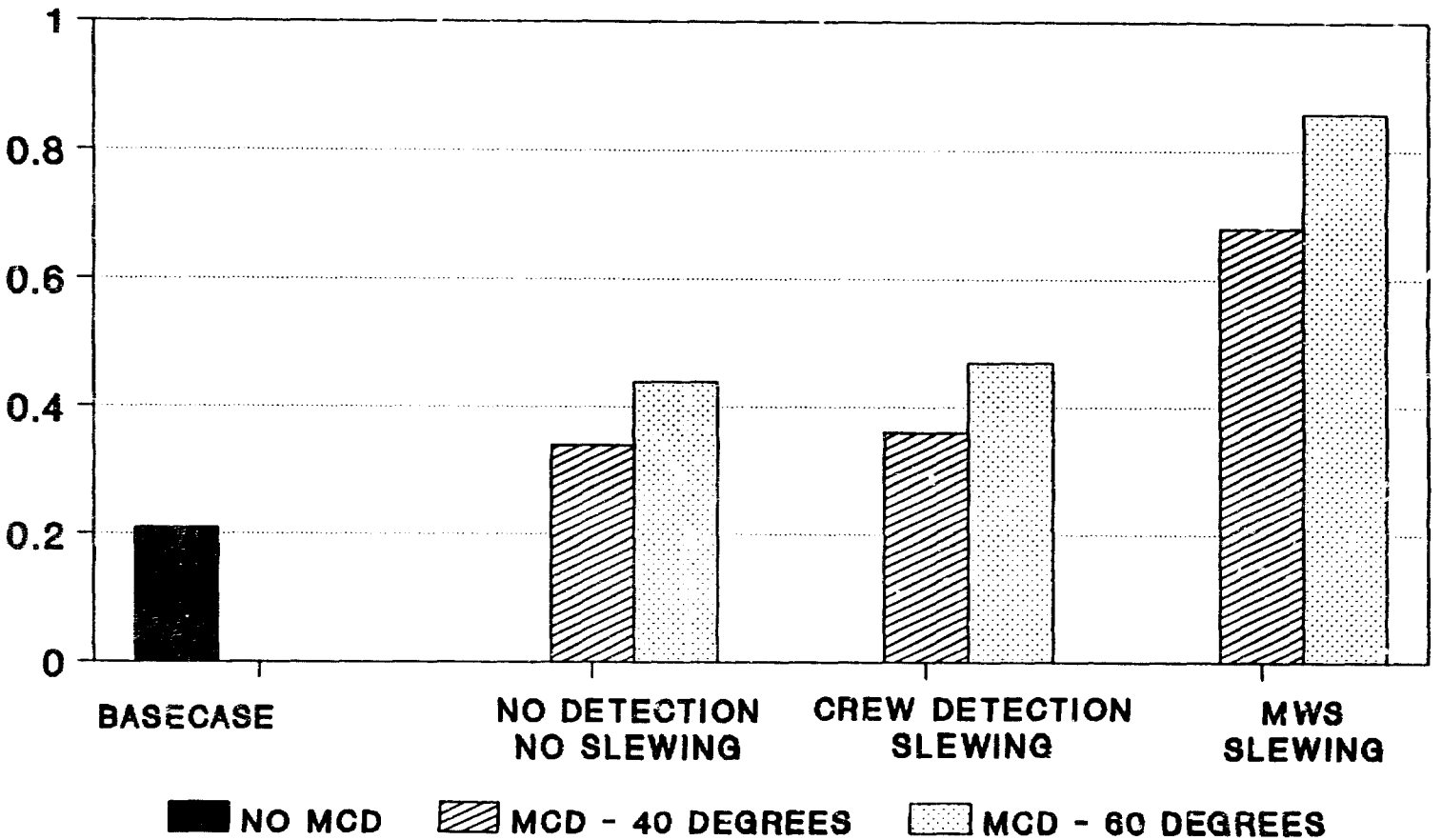
	MCD			Detection		
	None	40 deg FOV	60 deg FOV	None	Crew (W/ Turret Slewing)	MLD
Suite 1 (baseline)	X			X		
Suite 2		X	X	X		
Suite 3		X	X		X	
Suite 4		X	X			X

Analysis Tool
Groundwars Combat Model

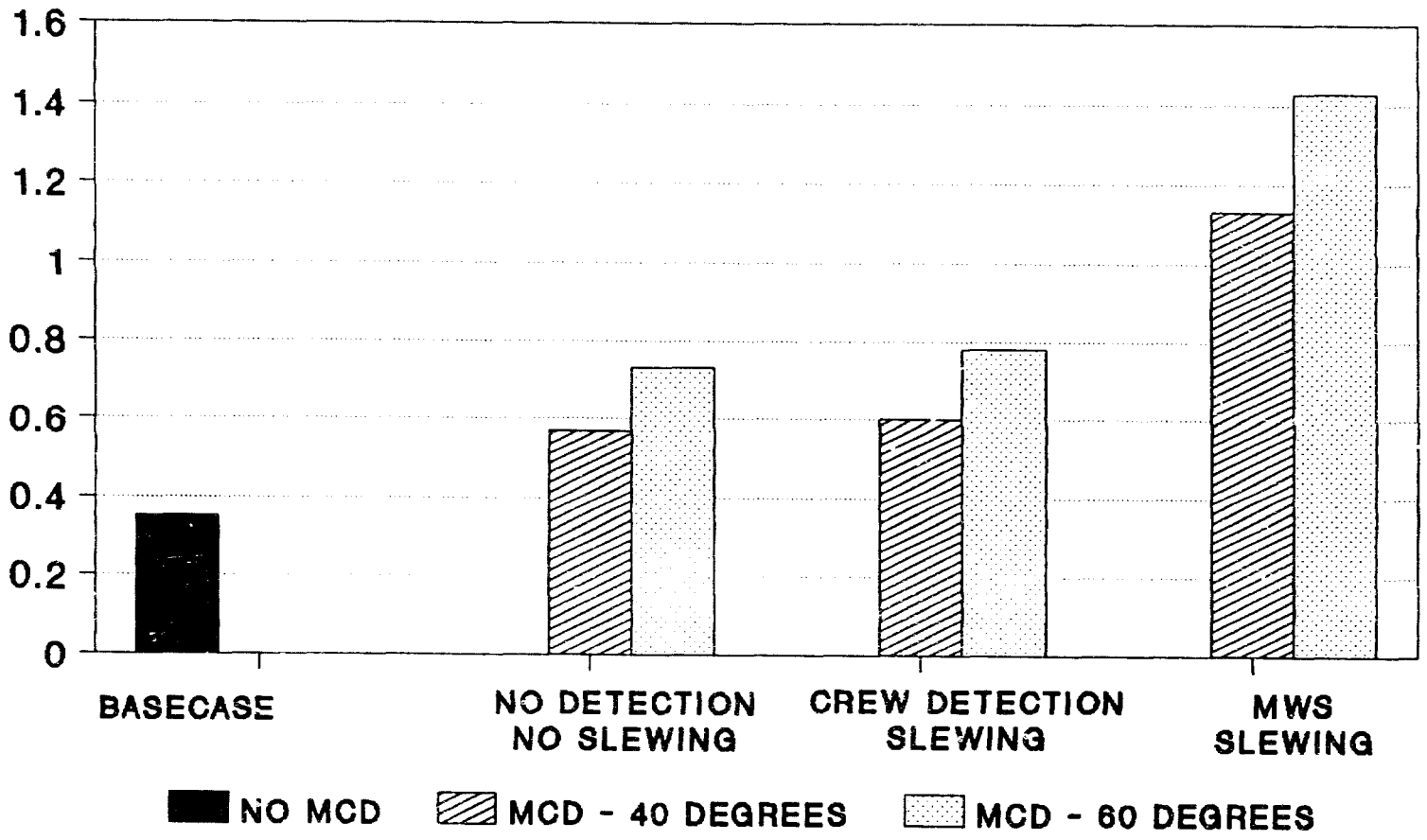
- Stochastic combat model in which both sides have homogeneous forces totalling 20 or less
- All attackers begin the simulation separated by the same distance from each defender
- Statistically simulated terrain
- Round type (KE, ATGM, Fire & Forget), firing cycle times, accuracy, and probability of kill are all explicitly modelled
- Game ends at a pre-determined range, or when a side is all dead or all out of ammo
- Version 4.2 models acquisition more precisely and models more countermeasures

RESULTS

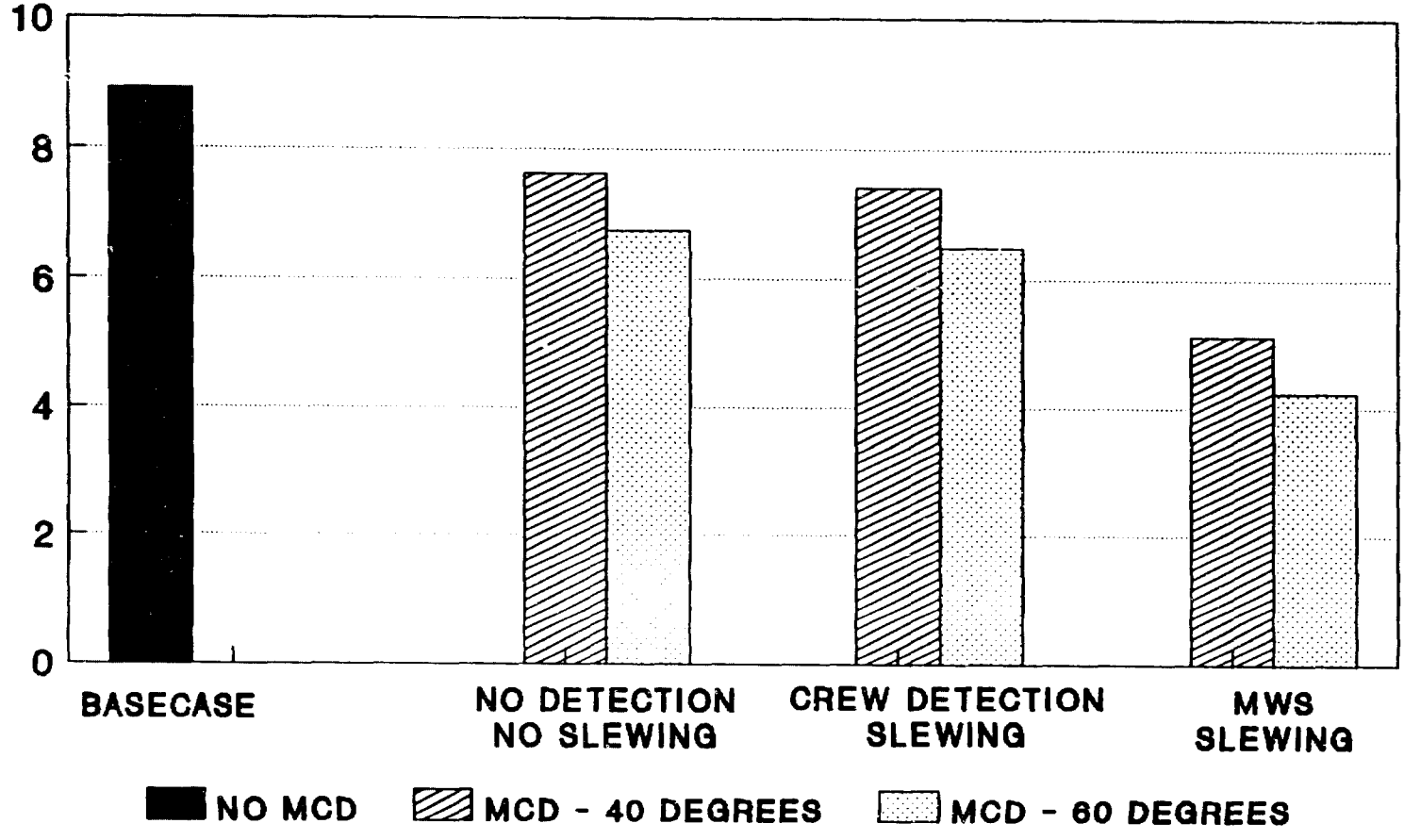
BLUE ATTACK
EXCHANGE RATIO



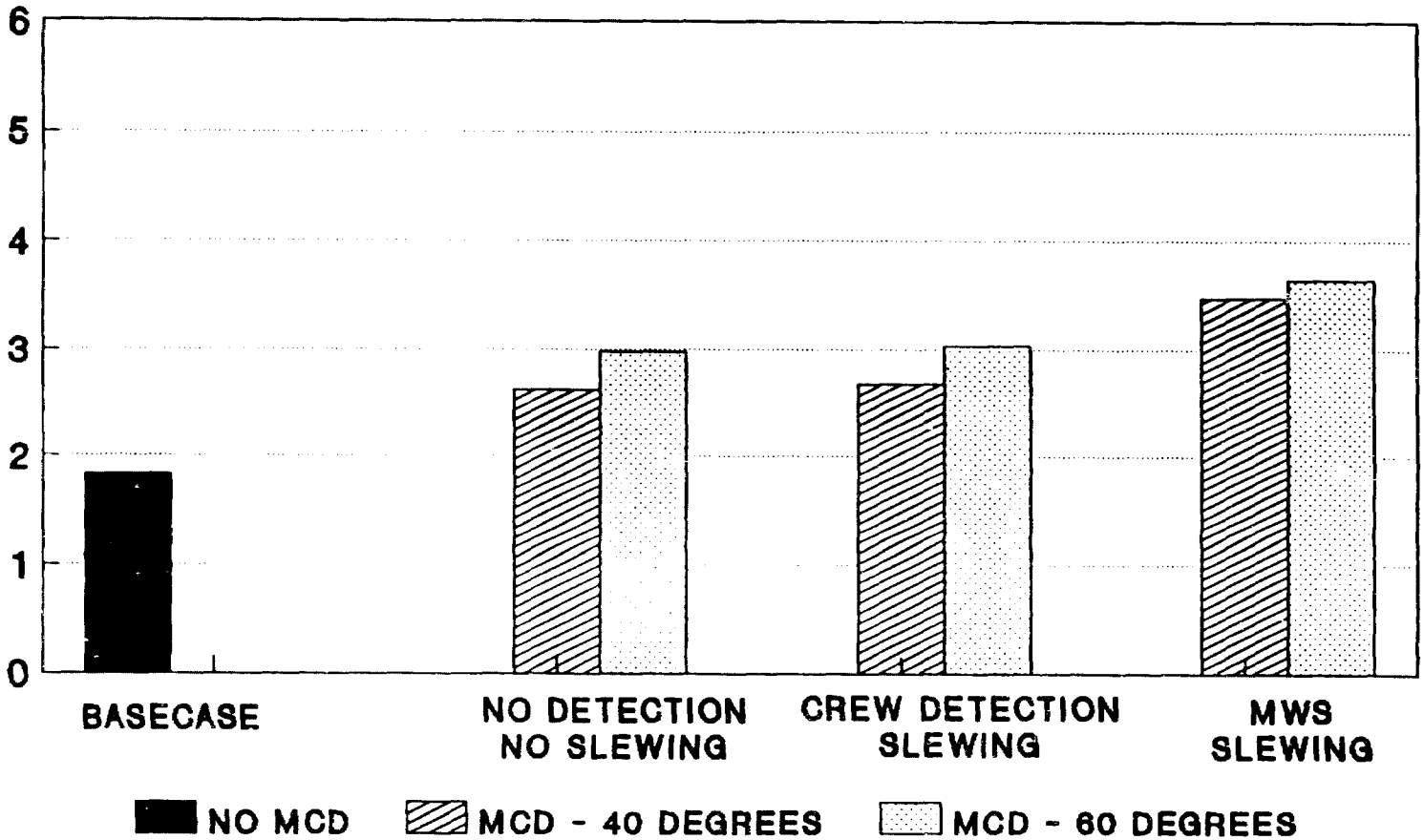
BLUE ATTACK
FRACTIONAL EXCHANGE RATIO



BLUE ATTACK
AVERAGE # OF BLUE DEAD

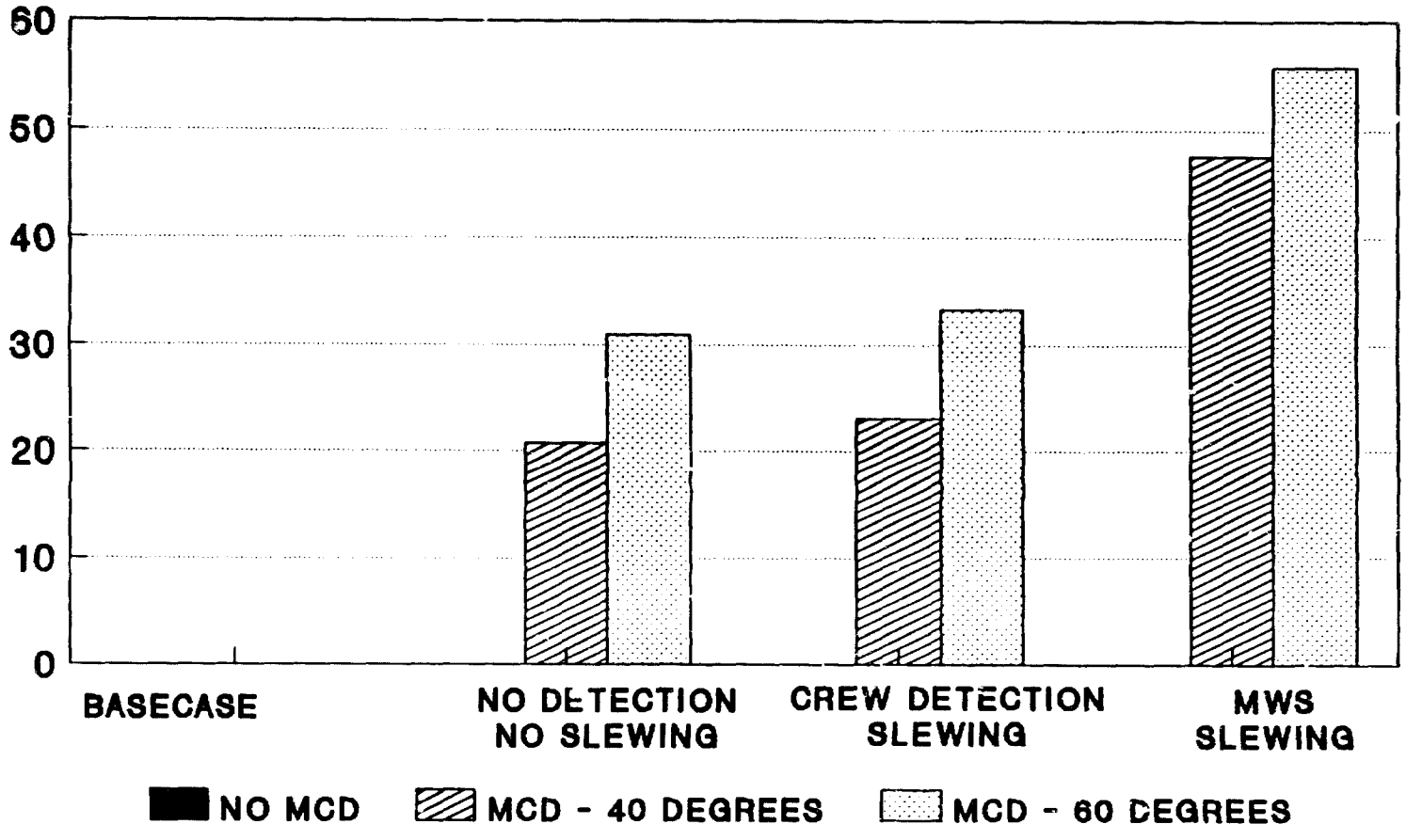


BLUE ATTACK
AVERAGE # OF RED DEAD

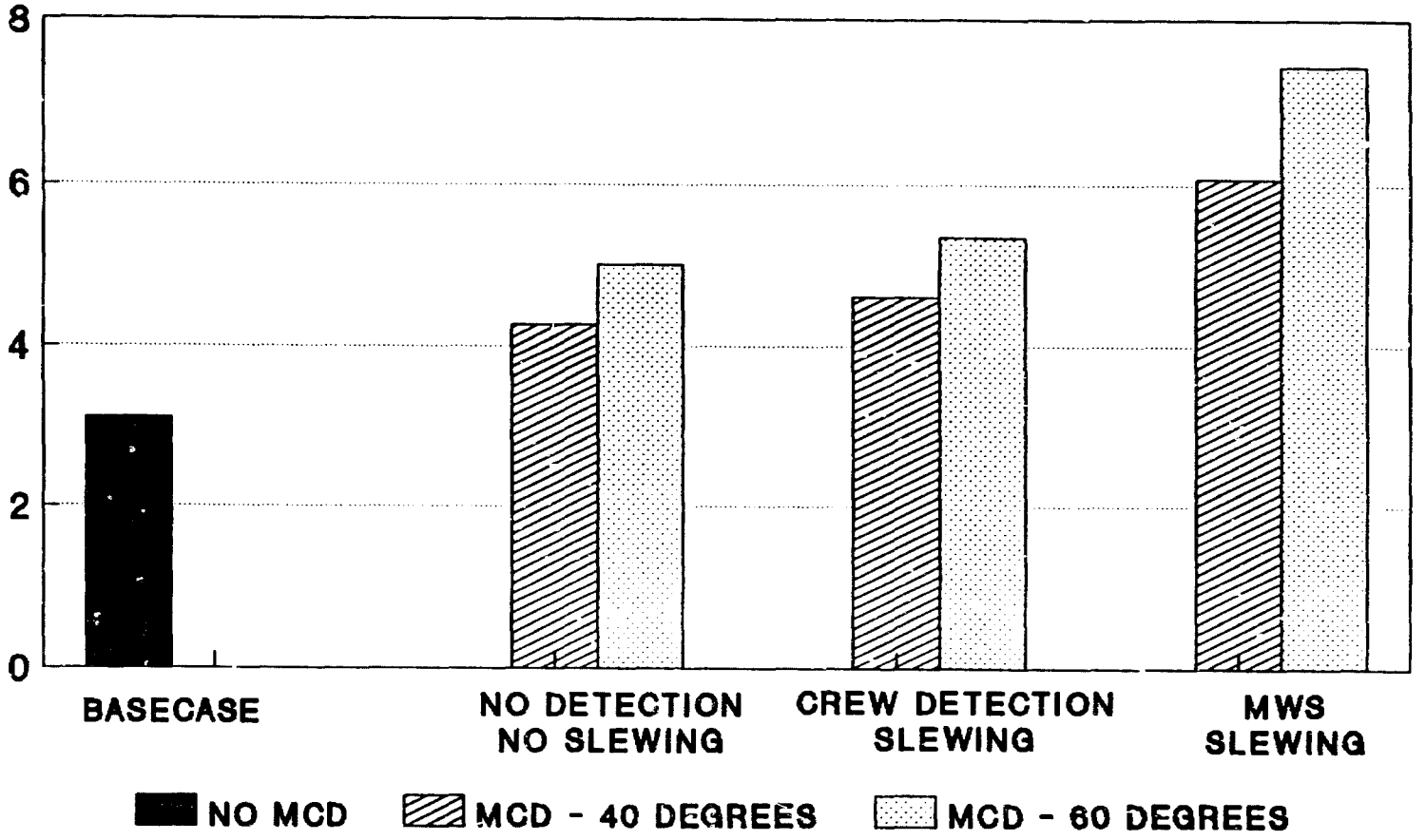


BLUE ATTACK

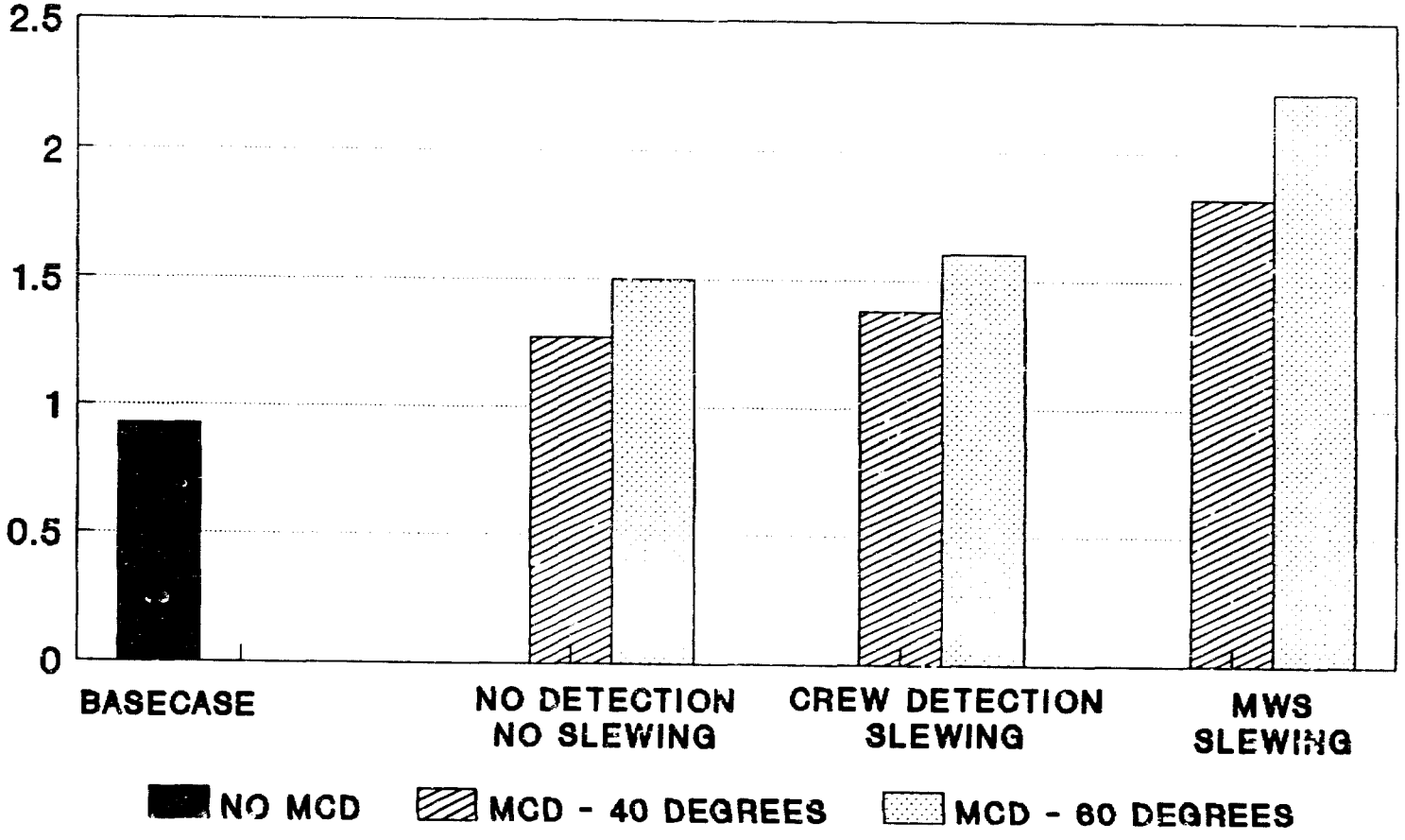
% OF RED SHOTS DEFEATED BY MCD



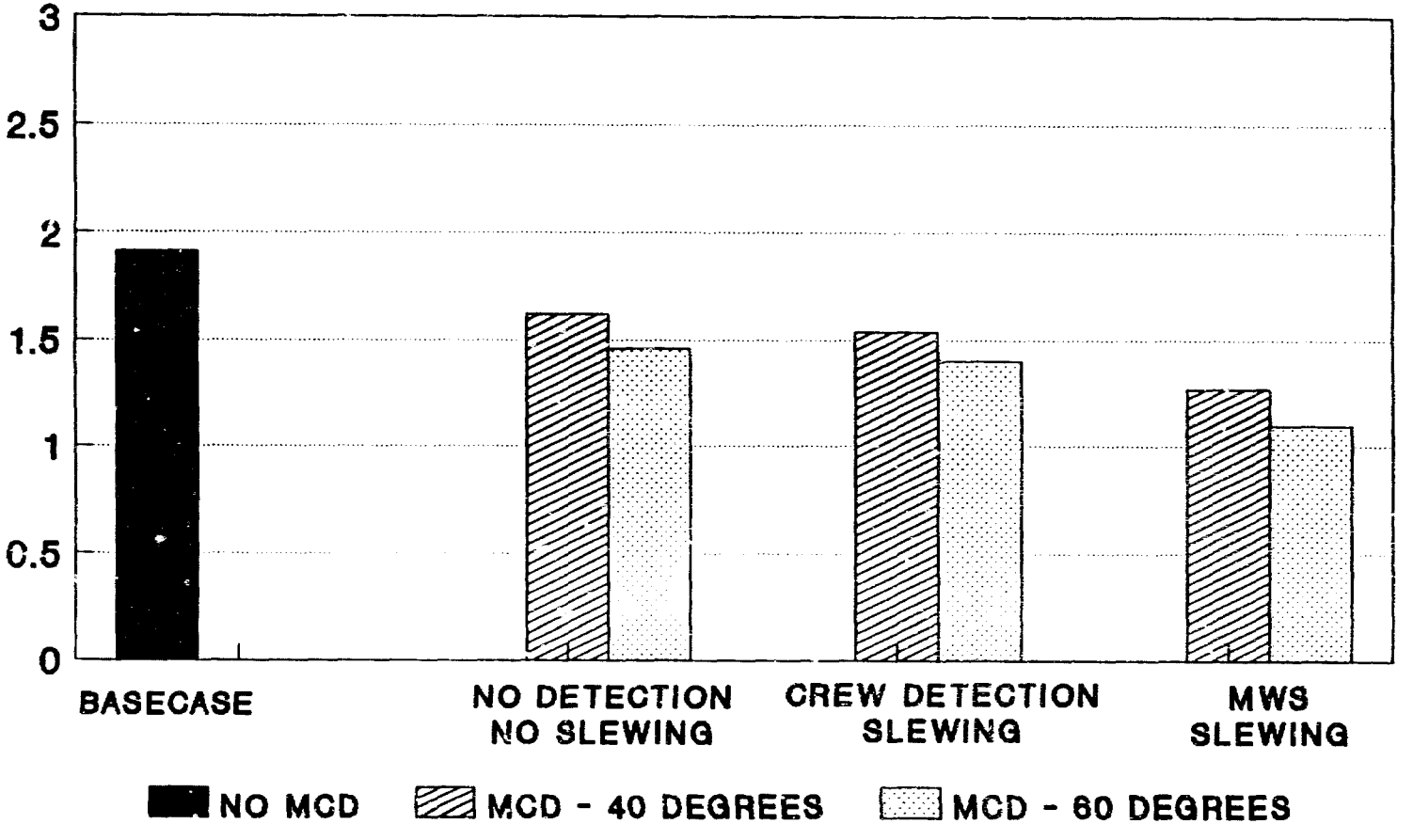
BLUE DEFENSE
EXCHANGE RATIO



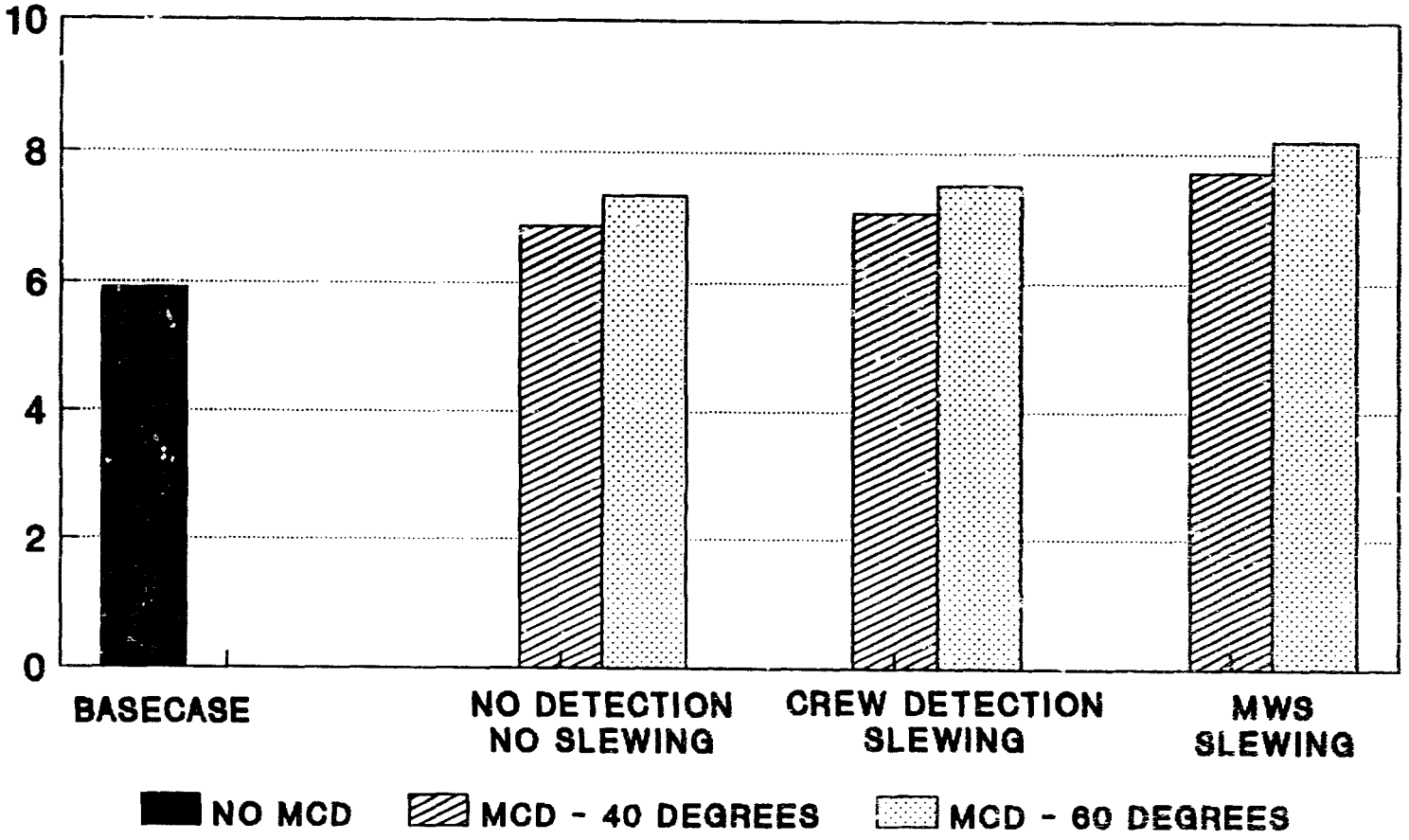
BLUE DEFENSE
FRACTIONAL EXCHANGE RATIO



BLUE DEFENSE
AVERAGE # OF BLUE DEAD

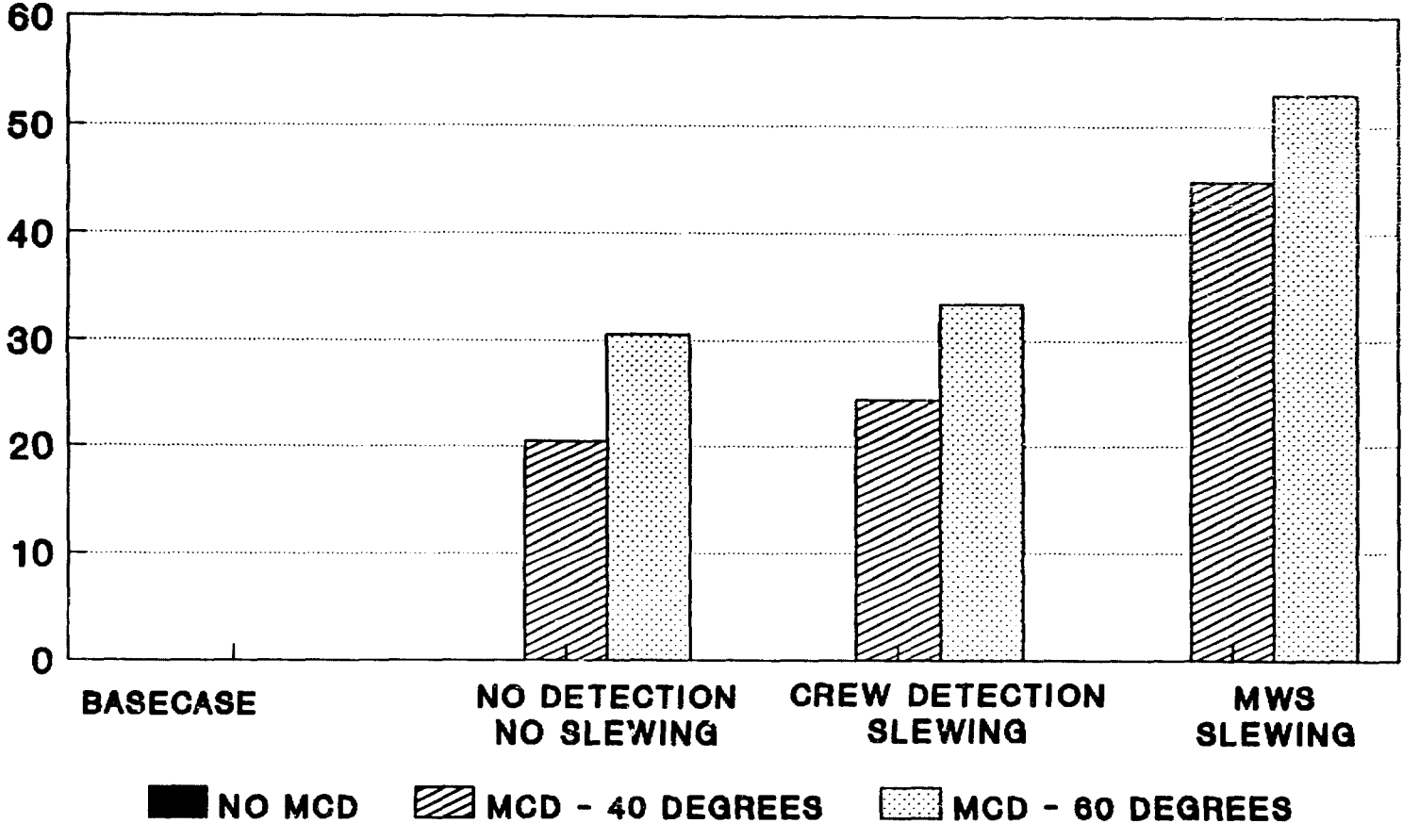


BLUE DEFENSE
AVERAGE # OF RED DEAD



BLUE DEFENSE

% OF RED SHOTS DEFEATED BY MCD



CONCLUSIONS

- The MCD showed more benefit in attack than in defense. (Compared to the basecase, Suite 3 showed a 70% improvement in the Exchange Ratio in attack and a 50% improvement in defense.)
- The MWS influenced the effectiveness of the MCD more in attack than in defense. (Compared to Suite 3, Suite 4 showed a 90% improvement in the Exchange Ratio in attack and a 30% improvement in defense.)
- The MCD with a 40 deg FOV was less effective than the MCD with a 60 deg FOV (15% to 22% less effective).
- The MCD combined with the MWS and turret slewing provides the most improvement in survivability.
  - •• Doubled the percentage of shots defeated as compared with an MCD alone.
  - •• Doubled the basecase Exchange Ratio in Defense, tripled it in attack.
- Turret slewing upon crew detection is slightly beneficial.

RECOMMENDATIONS

- The MCD program should be pursued in conjunction with the MWS. The ability to detect an incoming round and to receive it within the FOV of the MCD should be optimized. This could be pursued through such efforts as increasing the FOV as much as possible and incorporating automatic slewing.